

IMPACT OF TRITIUM LIQUID RELEASES IN THE CHANNEL SEA ON THE MARINE ENVIRONMENT: DILUTION AND TRANSFER TO BIOTA.

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Tritium is considered as having a low radiotoxicity but, in the absence of abatement technique, releases by nuclear energy production facilities are expected to rise worldwide in the near future and this radionuclide is actually a focus of attention of the public. The northern Cotentin area (Normandy, France) hosts the nuclear fuel recycling plant of La Hague (AREVA NC) and the nuclear power plant of Flamanville (EDF). These facilities release liquid tritium in the Channel Sea, resulting in a significant increase in tritium labeling in the marine environment. Though tritium is mainly discharged as tritiated water, transfer to organic matter rapidly occurs by photosynthesis and tritium gets involved in the element natural recycling. Assessing the impact of tritium releases requires examining the hydrodynamic dilution of the discharges and investigating the transfers between tritiated water (HTO) and organically-bound tritium (OBT). The actual knowledge on hydrodynamics in the Channel Sea allows modeling numerically the dilution of tritium discharges. Matching calculations data with almost 15,000 seawater sample measurements allowed tuning finely operational models adapted to different geographic scales. Actual available tools allow assessing the impact of tritium releases on water concentration with a very high accuracy and reliability. Animations on maps are displayed to illustrate the results provided by the models. In water, tritium measurement data are expressed in Bq.L^{-1} and this unit can be converted into isotopic ratio (1 Bq.L^{-1} corresponding to a T/H ratio of $8.1 \cdot 10^{-18}$). On the other hand, tritium can be extracted from organic matter by complete oxidation through combustion and water trapping. Then it can be quantified as tritiated water and expressed in Bq.L^{-1} of combustion water. This procedure makes it possible to compare the isotopic ratio in seawater (HTO) and in living organisms (OBT) and check whether tritium transfer processes result in the same isotopic ratio in both compartments. In the Channel Sea, samples from the marine environment showed that the isotopic ratio is similar. However, discrepancies are observed where changes in water are sharp (close to the source of input) because slow components of the transfer processes between HTO and OBT smooth changes in organic matter. This phenomenon would explain that when HTO decreases, trapped organic matter (in sediment for example) could display a higher value in OBT due to remanence. Another situation where OBT may be clearly higher than HTO is when other sources than tritiated water may be released by facilities. This was the case in the Severn Estuary (UK) in the 90', when releases from Cardiff GE Healthcare Ltd facility resulted in tritiated organic molecules with a high isotopic ratio in the marine environment. Living organisms incorporating these molecules displayed higher OBT than seawater HTO. These processes are presented and illustrated with data from the marine environment in different locations.